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ABSTRACT

In order to optimize learner performance in all the conditions of learning, Gagne proposed the application of a nine-step process called the events of instruction. Events 1, 2, and 3--gaining attention, informing learners of the learning objective, and reminding learners of prerequisite skills fall within the rubric of preinstructional activities. The preinstructional activities investigated in this study were advance organizers, performance objectives, and structured overviews. A total of 674 students in their first year of training at the Gweru and Bulawayo-Hillside Teacher's Training Colleges in Zimbabwe participated in the study. Four levels of treatment variables were used: control (CO), structured overview (SO), advance organizer (AO), and performance objectives (PO). Participants were randomly assigned to one of four treatment conditions by randomly ordering each of the self-contained instructional materials. Instructional materials were two reading passages which covered technical and nontechnical subjects. Two achievement tests were administered to respondents. In general, the findings, which appear to be consistent with those of previous research, indicate that performance objectives may have the most beneficial effect on learning. (Contains 24 references.) (AEF)

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Title:

The Effects of Preinstructional Activities in Enhancing Learner Recall and Conceptual Learning of Prose Materials for Preservice Teachers in Zimbabwe

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It has been argued that organization is the hallmark of good instructional materials (Gagne´, 1965). Given the emphasis on prose and written materials in most educational systems, the sequencing and arrangement of subject materials appears to influence not only what students learn, but also their attitudes towards the efficacy and importance of instructional materials. Nowhere is this more important than in the preliminary phases of the design and development of instructional materials.

Hartley and Davies (1976) state that in addition to an efficient organization of instruction, good teaching and a well organized "bird's eye view" of a task supplies the learner with a useful perspective of what will subsequently be encountered. This type of cognitive organization helps the learner to integrate new ideas and experiences with what s/he already knows.

A review of the results of previous studies obtained shows that recall and conceptual learning of prose materials are facilitated by the use of advance organizers, behavioral objectives, orienting questions, pretest and posttest questions, reviews, and lesson prefaces (Allen, 1970; Ausubel, 1960; Ausubel & Youssef, 1963; Barker & Hapkiewicz, 1979; Duell, 1974; Huck & Long, 1973; Peleg & Moore, 1982; Rothkopf & Kaplan, 1972). When designing and developing instructional materials, a great deal of emphasis is placed on instructional strategies that serve as a basis for learner orientation.

The learning models by Bloom (1956) and by Krathwohl, Bloom & Masia (1964), classify instructional objectives into taxonomic categories. Gagne´ et al. (1988) classified criterion-based human performance into five categories: verbal information, intellectual skills, cognitive strategies, motor skills and attitudes. In order to optimize learner performance in all the conditions of learning, he proposed the application of a nine-step process called the events of instruction. Events 1,2, and 3--gaining attention, informing learners of the learning objective, and reminding learners of prerequisite skills,--respectively fall within the rubric of preinstructional activities. The preinstructional activities investigated in this study were advance organizers, performance objectives, and structured overviews.

Advance Organizers

Studies carried out during the past 30 years present a diverse and sometimes conflicting scenario on the facilitative effects of advance organizers. Over 100 studies have investigated the effect of the Ausubelian organizer at one time or another since Ausubel's (1960) preliminary experiments (Luiten, Ames, & Ackerson, 1980). In spite of the conflicting results on the efficacy of the advance organizer, an analysis of well-designed studies suggests tentative support for the organizer technique, especially if the instructional materials are not well-organized to begin with and the target learners have limited prior knowledge of the subject matter.

Variations in the types of organizer tasks, recall and comprehension measures, validity and reliability measures, and student characteristics have broadened the range of available data. This has resulted in methodological and theoretical implications that at times are at variance with Ausubel's advance organizer theory. An important component of this study was to narrow the definition of the advance organizer in order to make it easier for it to be operationalized.

Performance Objectives

Research on performance objectives began 50 years ago. In excess of 100 studies have investigated the effect of prescribing behavioral objectives prior to instruction. The metamorphosis of performance objectives is reflected by the variety of names of which they are sometimes known: behavioral objectives, instructional objectives, mission objectives, outcomes, intents, etc. (Merrill, 1971, Fig. 2, p. 78).

Duchastel and Merrill (1973) reviewed several studies on performance objectives and came up with a tentative generalization. They found that out of the six classes in Bloom's (1956) taxonomy of educational objectives (knowledge, comprehension, application, analysis, synthesis, and evaluation), the utility of the behavioral objective strategy appeared to be more useful with higher levels of learning tasks which call for analysis, synthesis, and evaluation.

Although a number of studies (e.g., Hartley & Davies, 1976), have failed to support the hypothesis that students who are provided with performance objectives achieve more than students who are unaware of objectives, a sufficient number of investigations have confirmed the hypothesis to allow a cautious but affirmative opinion on the question of the efficacy of behavioral objectives. The conditions under which behavioral objectives can be considered facilitative remain sketchy and cannot be generalized across global populations. An important component of this study therefore was to control for any prevarication in the manner in which performance objectives are defined and operationalized.

Structured Overviews

Generally structured overviews have been grouped into several categories and are sometimes referred to as graphic organizers, mapping, webbing, pyramiding, graphic summaries, or structured overviews (Cassidy, 1989). For purposes of consistency in operationalization, this instructional strategy henceforth will be referred to in this study as structured overviews.

Researchers have found that using structured overviews as part of preinstructional activities can facilitate student learning and retention of instructional materials (Hartley & Davies, 1976) as well as serve as a "blueprint" for constructing meaning (cited in Greenwald, 1988). In studies done by Carr, Snouffer and Thistlewaite (cited in Greenwald, 1988) structured overviews have helped to activate prior knowledge crucial to understanding passages as well as increased incidental learning.

Cassidy (1989) has taken a more contemporary view--one more closely associated with the context in which structured overviews are used in this study. He has defined a structured overview as a cognitive map in which important aspects of a topic, concept, or unit of study are identified and arranged in a visual pattern with appropriate verbal labels. Again, this definition of structured overviews was adopted in order to narrow its definition as well as make it fairly easy to operationalize.

Hartley and Davies (1976) pointed out that a great deal of success attributed to structured overviews is thought to lie in their ability to emphasize salient points as well as to select and condense instructional materials. Overall, however, the results of the studies reviewed showed generally facilitative effects of structured overviews on learning and retention of textual materials.

Many studies (Duchastel & Merrill, 1973; Hartley & Davies, 1976) have been conducted on the effectiveness of these variables, although very few of them have been documented outside the confines of industrialized countries. In fact, of the more than 800 studies accessed from the ERIC Documents database and Dissertation Abstracts International dealing with the subject of one or more preinstructional activities, none was carried out in Sub-Saharan Africa.

Despite technological advances in information dissemination throughout the world, it is clear that printed materials continue to form the bulk of instructional resources used in schools and training environments in developing countries. The rationale for this study was to determine the efficacy of implementing different instructional strategies using printed materials and subsequently evaluating their capability to facilitate learning. This study was carried out in Zimbabwe where, as the case in most developing countries, the principal problems appear to be a rapidly declining quality in educational standards and a poor instructional design infrastructure (Moock & Jamison, 1988). Moock and Jamison (1988) further point out that undesirably low levels of student achievement and performance experienced in sub-Saharan African countries is a direct result of two problems: (a) internal inefficiency, that is, the educational systems in these countries make poor use of available instructional resources; and (b) they lack the resources or adequate financing to improve the present curriculum design infrastructure. In Zimbabwe, both factors are operative. The country also primarily depends on printed instructional materials, particularly textbooks, as the most appropriate media for improving the quality of instruction.

In this study, the use of selected preinstructional activities was investigated in Zimbabwe's preservice education corps. Using two achievement tests with different performance domains, the study investigated the treatment effects of the following preinstructional activities: 1.) advance organizers; 2.) performance objectives; and 3.) structured overviews. The data gathering instruments were therefore designed to measure maximum performance.

The specific hypothesis tested in this study was:

There would be significant differences between the population means of posttest scores between the traditional approach or control group (CO) and each of the preinstructional strategies, namely, performance objectives (PO), advance organizers (AO), and structured overviews (SO). The rationale behind this was that each treatment variable was expected to enhance recall and learning of specific facts and concepts as they pertainedto the lessons by both focusing the learning effort on relevant information and detracting attention from incidental material. Through the process of orienting the learners to what they would have to know, it was expected that they would be better prepared in learning the most important and relevant parts of the lessons prior to taking the posttest.

Participants

A total of 674 students in their first year of training at the Gweru (n=340) and Bulawayo-Hillside Teacher's Training Colleges (n=334) in Zimbabwe participated in this study. Of these, 408 were males, 193 females. The average age of the participants was 19 and 73 students failed to specify their gender. It must be pointed out that at both

locations, participant mortality in the second reading passage was considerable due to the fact that some subjects conceded familiarity with the subject matter.

The two colleges were selected because of the fact that they are the premier preservice teacher training institutions in Zimbabwe. Between them, they represent approximately 60% of the annual pool of preservice teachers who are trained to teach in Zimbabwe's secondary schools. They are also strategically located to geographically cover the northern as well as southern regions which divide the country's two indigenous tribes, the Shona and Ndebele. Through government records, the two institutions were predetermined to have the most representative student body in the country. Geographical, tribal, and gender representation was enhanced by a government fiat which stipulates an admission policy based on regional quotas for both colleges.

All participants were first year trainees who had been admitted after having passed Advanced Level secondary school with a first class or high level second class. Their classification would be equivalent to college freshman in the United States while their entry level grades would represent A or B-plus respectively. The training for all participants was structured to be inclusive of arts and science subjects.

To increase power and precision, this study sought the participation of the whole student population from both colleges. As a matter of national pride and duty, all subjects were asked to volunteer their time in participating in the study as the results were to impact on the designing and development of Zimbabwe's post-independence curricula. In all, participants represented approximately 80% of the freshman student population for both colleges.

Experimental Design

The independent variables in this study were defined as advance organizers, performance objectives, and structured overviews. These have been defined in the introductory chapter of this study.

Four levels of treatment variables were used: control (CO), structured overview (SO), advance organizer (AO), and performance objectives (PO). The three treatment variables (structured overview, advance organizer, and performance objectives) were studied in isolation from one another. The outcome of each variable was expected to reflect its contribution to the study.

Student participants at the two colleges were randomly assigned to one of the four treatment conditions by randomly ordering each of the self-contained instructional materials. In classes that averaged roughly 100 participants per session, a random-ordering system that involves randomly ordering and marking each of the four types of instruction, say 1, 2, 3, and 4, and distributing them was used.

In addition, all modules representing different treatment conditions were color coded. After random assignment of the treatment conditions, participants were assigned to four sections of the room each representing their module by color. Student participants at each location were asked if they were familiar with the selected reading passages before they began with the exercise. Those who had any prior knowledge of the narratives were dropped from the sample. Participants were also asked to record the time they started and finished both the reading module and the posttest. Each student was given 45 minutes to read a passage, and a fifteen-minute posttest followed immediately. This process was repeated with the delivery of the second set of the written modules and posttest.

The achievement measures were recall and conceptual learning as determined by the administration of two immediate posttests. A simple one-way analysis of variance (ANOVA) design was utilized to analyze the data.

A technique proposed by Glass (1978) by which treatment effects may be quantified, standardized, and compared using the "effect size" statistic (E.S.) was also used. The rationale behind this was to examine all effect sizes, regardless of magnitude, and the degree to which they were worthy in their own right.

Materials

In this study, two reading passages unfamiliar to the participants were selected and developed. The rationale behind using two instruments was to determine whether uniform results could be found after applying both instruments to participants within the same population. An additional reason for using two lessons with two achievement tests was to increase the power and precision of the overall instrument.

The content of both instructional materials covered technical and nontechnical subjects so as to be inclusive of the participants academic background, which was science and humanities. The first reading passage, amounting to approximately 800 words, was adapted from a textbook on still photography (Grimm, 1985). The passage had technical language that dealt with the basic operational functions of the 35 millimeter single lens reflex camera. The title of the passage was The Basic 35 Millimeter Camera.

Refinement of the reading passage included eliminating any parts of the text that were deemed superfluous and potentially distorting or confusing to the participants. All sectional headings, subtitles, pull quotes or any other attention getting devices were removed in order to avoid any interactions with the treatment variables.

The readability of the text was verified using a computer program to ensure it was at the Zimbabwe Grade 7 (U.S. 8th grade) level and thus, presumably below the participants maximum reading level. The reading materials were timed for reading length to ensure that they would be of appropriate length given the permissible time allocated to the researcher. The second reading passage, amounting to approximately 750 words, was adapted from a book featuring timed readings (Spargo & Williston, 1980). The selected passage dealt with the topic of American bald eagles. This passage, entitled The Bald Eagle, was less technical in presentation, substance and style than the first passage. Materials were developed by the researcher into a reading text by combining information from subject matter experts in the area dealing with the American bald eagle.

In order to avoid any interactions with the treatment variables, the same refinement procedure used for the first reading passage was applied to the second lesson. The reading materials were also timed for reading length and readability level.

Because the first reading passage was more technical and somewhat more complex than the second one, an item analysis on the post-tests of both passages was conducted. This was to indicate the percentage of participants who correctly answered each item on both test components.

The text materials were formatively evaluated to determine whether indeed, they were appropriate. Editorial advice was sought from a group of instructional design experts, two English Professors, and two high school students. This process was designed to ascertain the logical flow of ideas contained in the instruments.

A second formative evaluation for both reading passages was carried out in Zimbabwe under circumstances closely resembling the actual experimental conditions using teachers from a teacher's college in Harare. The initial developmental strategies were applied to conform to the original intention of the study.

For each reading passage, an advance organizer, a set of performance objectives, and a structured overview to be used as treatment variables were developed with the help of the same panel of experts who assisted in developing the reading passages and test items. Each intervention was formatively evaluated to maintain consistency between the lesson content and ideas from the treatment variables. Special consideration was given to layout so as not to confound the target learners. All the treatment variables were printed in such a way as to be distinct from the reading passage.

The two achievement tests accompanying the reading passages were designed to measure two levels of skills: a) recall of information, and b) knowledge of concrete concepts. A list of items was drawn from each reading passage to represent the desired performance domain. Test items were divided into performance categories of verbal information and concrete concepts, the latter being a subcategory of intellectual skills (Gagne´ et al., 1988).

Validity and Reliability

To obtain a performance indicator that verbal information had been acquired, participants were asked to state in writing different pieces of information related to the passages. As a performance indicator that concrete concepts had been acquired, participants identified objects by their properties or classes, and animals by their species or special characteristics.

All verbal information was organized and presented in statements which were comprised mostly of facts or declarative information. Concrete concepts were presented by widely varying their characteristics so that each individual participant was asked to identify by circling, choosing or checking from a group. Concepts such as species or types of mechanical devices were identified in this manner as well.

A uniform procedure was used on both achievement tests to establish content-related validity. This procedure involved developing the tests based on a set of performance objectives (Mager, 1962).

In order for student performance to be legitimately represented by a single score, each achievement test or subtest had to measure a single learning domain pertinent to each given written instruction. Each achievement test used in this study was checked for internal consistency using the Kuder-Richardson or KR-20 formula.

Procedures

The strategy for administering the instruments was for the researcher to travel to the different teachers' colleges at which he administered the treatment and instruments with the assistance of members of staff at the two colleges. All participants were advised of the relevance of the study and its implications regarding the development of Zimbabwe.

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They were also advised of the implications of the study from the point of view of an instructional design and materials development.

Analysis of the Data

This study design involved administering two achievement tests to respondents. Participants in the first achievement test exercise were comprised of 470 first year preservice teachers from Gweru and Bulawayo-Hillside Teacher's colleges. This group was referred to as the 35mm SLR group. Participants in the second exercise were comprised of 204 first year preservice teachers from the same teachers' colleges. This group was referred to as the Bald Eagle group. The dependent measures for this study were recall and conceptual learning as determined by total posttest scores.

The results of the data analysis are presented in the following order: posttest performance on the two achievement tests, the 35mm SLR post-test and the Bald Eagle post-test. The Kuder-Richardson reliability coefficient alpha for the two sets of achievement tests data are shown in Table 1.

Table 1

Posttest Reliabilities: Kuder-Richardson (KR-20) Reliability Coefficient For the 35mm SLR and Bald Eagle Post-tests

Test Group	N	KR-20 Reliability
35mm SLR	470	.585
Bald Eagle	204	.627

The cell means, standard deviations and relative performance of the four groups are presented in Table 2.

Table 2

Means and Standard Deviations by Treatment Group of the 35mm SLR Group

Treatment Groups	n	Mean	E.S.	SD	S.E. ERROR
CO	109	13.670	-	2.506	.240
AO	119	13.899	.09	2.506	.230
SO	120	14.150	.19	7.430	.678
PO	122	14.008	.13	2.710	.245
Total	470	13.938		4.354	.201

Note: Maximum score is 18 for the posttest.

A one-way ANOVA was also computed for the first posttest. Based on the performances of each group, the differences between groups on the 35mm SLR post-test were not statistically significant. Since there was no significant univariate effect at alpha .05, any further analysis could not be warranted.

The results of participants in the Bald Eagle group are summarized in Table 3. Table 3 also shows the relative performances of the treatment groups, including the basic sample statistics.

Table 3

Means and Standard Deviations by Treatment Group of the Bold Eagle Group

Treatment Groups	n	Mean	SD	E.S.	Std.Error
CO	53	13.627	2.154	-	.302
AO	50	13.660	2.269	.01	.324
SO	52	14.980	2.661	.51	.376
PO	49	15.208	2.103	.75	.303
Total	204	14.359	2.405		.171

Note: Maximum score is 18 for the posttest.

A one-way ANOVA was computed on the Eagle posttest. Based on the performances of each group, the differences between the control group and the performance objective group were found to be statistically significant. The ANOVA also detected significant differences $F(.05; 3, 200)$, $p<.05$ between the control group and the structured overview group. There was no significant difference between the control and the advance organizer group.

A major problem in the technique used to analyze the data so far is that it does not take into account any positive treatment effect that fails to reach statistical significance. Hence studies showing positive, yet statistically non-significant effects are given no further analytical consideration. Such results may be biased against favorable yet non-significant results.

A technique proposed by Glass (1978) by which treatment effects may be quantified, standardized, and compared using the "effect size" statistic (ES), was found appropriate for this study. It is important to note here that the intention of using this effect size approach was not to test statistical significance of the effect size, but rather to offer an alternative in looking at group differences. It is also equally important to note that use of Glass's Effect Size technique was not to suggest any negation of non-significant outcomes from Analyses of Variance conducted in this study.

The effect size data for the 35mm SLR and the Bald Eagle groups post-tests are shown in Tables 2 and 3 respectively. Effect Size data appear to suggest that the treatment variables used in this study have a facilitative effect on learner recall and conceptual learning in varying degrees and magnitude.

In looking at data from the 35mm SLR group, the effect size range is from .09 to .19 suggesting a somewhat less than useful treatment effect in as far as the advance organizer is concerned. The effect of the advance organizer in this instance was of no practical importance. In looking at the effects of the performance objectives and the structured overviews groups, the difference between these two groups when compared with the advance organizer group, while larger, is still negligible.

Table 3 effect size indices appear to present a somewhat different composite picture. While the effect of the advance organizer remains of no practical importance, the performance objectives and structured overviews groups appear to have moderately useful to sizable effects on learner recall and conceptual understanding. In looking at both achievement tests, the trends in the data seem to be fairly consistent. Results seem to indicate that the advance organizer was the least effective preinstructional activity when compared with performance objectives and the structured overview.

Discussion

In general, the findings in this study appear to be consistent with those of previous research (Duchastel & Merrill, 1985; Barnes & Clawson, 1975; Gagne´ et al., 1988). These results seem to indicate that performance objectives may have the most beneficial effect.

Despite the small differences in the means between groups in the first achievement test, the trends in the data, when compared with the second achievement test, seem to be fairly consistent. In both achievement tests, performance objectives come out relatively superior to any of the other treatment variables. Structured overviews appear to rank second, followed by advanced organizers.

With respect to the overall framework of the study, several issues appear to require some explanation. There remains the question of why the differences between the treatment groups in the 35mm SLR group were not statistically significant while significant differences were detected between groups in the Bald Eagle group.

An initial explanation may be found in the differences in content between the two passages. The 35mm SLR reading passage was relatively more technical than the the Bald Eagle passage. In conducting an item analysis on both test components, item difficulty, as indicated by the percentage of students who correctly answered each test item, was much higher in the the 35mm SLR group passage than the the Bald Eagle group passage. The average item difficulty index for the 35mm SLR group was .70, while the item difficulty index for the Bald Eagle group averaged .76.

Another observation here is, by design, advance organizers are fairly complex to describe and interpret, and hence they are likely to be inconsistent in terms of how effective they may be. The impact of the advance organizer as it is designed in this study may have had been more pronounced on higher level learning than simple factual recall. Simply committing facts to memory may be a less demanding process than understanding material to the point where learners are expected to answer questions that draw on information not explicitly contained in the material to be learned. Since the advance organizer is supposed to facilitate comprehension, and the structuring together of old and new information, it is likely to have more impact on higher level learning than on factual recall and recognition.

By comparison, the performance objectives and structured overviews leading to both reading passages in this study provided specific information derived directly from the content of each lesson. Both of these preinstructional strategies provided precise and unambiguous information upon which the learner was expected to focus.

In the context of a developing country such as Zimbabwe, data from the two achievement tests administered to preservice teachers appear to support the use of preinstructional activities in the design and development of lessons. Central to this discussion is the fact that traditionally, the teacher within the Zimbabwean educational context has always been viewed as supreme within a pedagogical environment. Instructional materials such as textbooks, media, and other support resources, are secondary. The instructor's use of any of these support systems is discretionary, not mandatory. Coming at a time when the government of Zimbabwe is trying to remove the vestiges of colonialism from its curricula, these findings may be somewhat important.

The findings of this research also seem to suggest that stated preinstructional activities may have a global pedagogic value. Furthermore, it is important to note that this study may be one of very few ever done outside the United States and Western countries in general.

While overall the present findings provide limited support for the types of preinstructional strategies investigated in this study, it is important to note that these results do not depart from pervious research on the same topic. For example, in the experimental phase of this study, the effect of performance objectives appears to be consistent with results from previous studies (Barnes & Clawson, 1975; Duchastel & Merrill, 1973). This may suggest that the effective and efficient use of preinstructional activities traverses cultures and international boundaries.

While it may be useful to determine the practical significance of the use of preinstructional activities, future studies may also find it equally important to consider the costs of using such innovations. Evidence of effectiveness may then be tied to guidelines and/or standards in ways that deal more realistically with the present emphasis on efficiency and accountability for the use of scarce public and private financial resources. Better understanding of the instructional systems design approach should be encouraged, as it is a method which has already proven useful in demonstrating effective instruction.

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